RICH-MAR®

THERASOUND SERIES

OPERATION MANUAL

Rich-Mar, Inc.
Part Number: 410-125
Revision 1.0

Thank you for purchasing Rich-Mar Products!

The new Therasound 3 Series utilizes the same features and reliable internal components as before, but is now enclosed in a new stylish housing. The new look, coupled with the new "Plug & Play" Ultrasound Applicator technology makes this the most versatile Therasound 3 unit ever offered by Rich-Mar.

Again, thank you for your purchase and loyalty to Rich-Mar Products.

Best regards,

Chad Morgan
Vice President/Sales & Marketing

Quality Policy Statement

Our Policy at Rich-Mar will be to meet or exceed the needs of all our customers, both internal and external, by providing them the best value in all of the Products and Services we offer to our industry.

It is our intent to be known as **Rugged, Reliable, Rich-Mar.**

RICH-MAR®
MAKING WAVES IN THERAPY

CAUTION

This device is not designed to be connected with any electrical equipment unless manufactured and approved by Rich-Mar.

NOTE: This includes whirpools and carbon electrodes NOT manufactured by Rich-Mar.

CAUTION: When using carbon electrodes with any Rich-Mar stimulator, a moistened interface (cloth or sponge) MUST be utilized between these electrodes and the patient to avoid skin irritation and/or electrical burns.

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WARRANTY

Rich-Mar warrants that our units are free of defects in material and workmanship.
This warranty shall remain in effect for (3) three years from the date of original customer purchase.
If these Products fail to funtion during the three year warranty period due to a defect in material or workmanship, Rich-Mar or the selling dealer will repair or replace the respective Product without charge within a period of Thrity (30) days from the date on which the Product is returned to Rich-Mar.
All repairs to the Product must be performed by Richmar or a Richmar Authorized Service Center.

Any modifications or repairs performed by unarthorized centers or groups will void this warranty.

The warranty period for certain accessories is 90 days. These accessories consist of Lead Wires and Electrodes.
The warranty period for the Ultrasound Applicators is one year (12 months).

To participate in warranty coverage, the Product's warranty registration card (included with the Product) must be filled out and returned to Rich-Mar by the original owner within ten (10) business days from the date of purchase.

RICHMAR SHALL RESERVE THE RIGHT TO REQUEST PROOF OF PURCHASE FROM THE END-USER TO VALIDATE THE WARRANTY PERIOD

This Warranty Does Not Cover:

~ Replacement parts or labor furnished by anyone other than Rich-Mar, the selling dealer or a certified service technician.
~ Defects or damage caused by labor furnished by someone other than Rich-Mar, the selling dealer or a certified service technician.
~ Any malfunction in the Product caused by product misuse, including, but not limited to, the failure to provide reasonable and required maintenance or any use that is inconsistent with the Product's User's Manual.

RICH-MAR SHALL NOT BE LIABLE IN ANY EVENT FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES

Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusion may not apply to you.

To Obtain Service from Rich-Mar or the selling dealer under this warranty:

1. A written claim must be made within the warranty period to Rich-Mar or the selling dealer.

Written claims made to Rich-Mar should be sent to:

Rich-Mar, Inc.
4120 South Creek Road
Chattanooga, TN 37406
Telephone (423)648-7730 / FAX(423) 648-7735

and

2. The Product must be returned to Rich-Mar or the selling dealer by the owner.

This warranty gives you specific legal rights and you may also have other rights which vary from location to location.
Rich-Mar does not authorize any person or representative to create for it any other obligation or liability in connection with the sale of the Product.
Any representative or agreement not contained in the warranty shall be void and of no effect.

THE FOREGOING WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTY OR MERCHANT ABILITY OR FINESS FOR A PARTICULAR PURPOSE.

Ultrasound Indications for Treatment

(Therapeutic Ultrasound)

Rich-Mar Ultrasound devices are indicated to produce therapeutic deep heat for the following conditions:

1) Relief of pain.
2) Muscle spasms.
3) Joint contractures.

But not for the treatment of malignancies.

WARNING - Federal law restricts this device to sale by or on the order of a physician or any other practitioner licensed by the law of the state in which said person practices.

Ultrasound Contraindications

Contraindications

Ultrasound should not be used in the following areas:

1) Near or over the heart.
2) Near or over the eyes.
3) On the head.
4) Near or over reproductive organs.
5) On the lower back during pregnancy or over the pregnant uterus.
6) Directly over the spinal column.
7) Over growing bone in children.
8) Where the skin suffers from any sensory impairment.
9) Over areas of malignancies.
10) In the area of visceral plexus and large autonomous ganglion.
11) Over the thoracic area if the patient is using a cardiac pacemaker.
12) Over a healing fracture.
13) Over ischemic tissues in individuals with vascular disease where the blood supply would be unable to follow the increase in metabolic demand and tissue necrosis might result.

Precautions

Precautions should be taken when used:

1) Over anesthetized areas.
2) On patients with hemorrhagic diastheses.
3) Ultrasound treatment should not be performed over an area of the spinal cord following laminectomy (i.e.- when major covering tissues have been removed).

Caution

1) Excessive doses of ultrasound may cause damage to tissue. Periosteal pain is an indication of excess intensity and if it occurs, the power should be reduced; the transducer should be moved more rapidly over the area being treated; or a lower pulsed duty cycle should be used.
2) If the soundhead has been operated unloaded for an extended period of time, the transducer will get hot. If the soundhead is applied to the patient while the transducer is hot, a burn may result.

Warning

Do not operate the soundhead in an unloaded condition. It is possible that unrepairable damage may occur to the transducer in an unloaded state.

Introduction

The Rich-Mar Therasound 3 and Therasound 3 EVO are designed to provide therapy professionals with the best technology at affordable prices. The Therasound 3 and Therasound 3 EVO products and accessories offer the most flexible treatment possibilities in a convenient, easy-to-use package. This manual is meant to familiarize the user with the controls, operations, and ultrasound therapies available on the Therasound 3 and Therasound 3 EVO units. The simple control of the units allows the user to master the units' vast capabilities quickly and easily.

Operation

NOTE: Ensure that an Ultrasound Applicator is connected into the back of the unit. If NO Applicator is installed, the 7-segment displays will indicate all 8's and the unit will not respond to any user key inputs.

To operate the unit, make sure that the power cord is plugged into the power receptacle on the back of the unit. The power receptacle is located below the On/Off switch. Turn the switch to the "1," or on position. The device should then activate. The Therasound unit will then go through a quick diagnostic check where some letters and numbers appear on the display. This is normal. After the diagnostic check green digits will appear in the time and intensity windows. To set up a treatment, select the parameters desired by pressing their corresponding buttons. A beep will sound every time a button is pressed on the device. Select the duty cycle (100%, 50%, 20%, or 10%) by pressing the Duty Cycle Select button. Then select the desired treatment time by pressing the "+" or "-" buttons in the "Time Set" area. Select how the intensity will be displayed, either in W/cm² or Watts, by pressing the Select button in the "Intensity" area. Set the intensity by using the "+" or "-" buttons in the "Intensity" area.

Once all treatment parameters have been set as desired, apply ultrasound-coupling lotion or gel to the patient and place the transducer on the patient. Press the "Start" button and the "Time" indicator will start to flash. This indicates that the treatment is running and time is counting down. Notice that the green "Ultrasound Active" indicator light is now illuminated indicating that the unit is now delivering ultrasound output wave forms.

Please note that any treatment parameter may be modified or changed while the device is operating simply by pressing the button corresponding to the parameter to be changed.

To pause treatment, press the "Pause" button. Time will stop flashing and the intensity will begin to flash.
Notice that the "Ultrasound Active" indicator light is no longer illuminated, indicating that the treatment has been Paused and the unit is no longer delivering ultrasound output wave forms.

To resume treatment, press the "Resume" button and the time will flash and the "Ultrasound Active" indicator will once again illuminate.

When the treatment time ends, a loud beep will sound and time will stop flashing and revert to the last treatment time entered. The intensity will revert to zero and the ultrasound active light will extinguish.

To stop a treatment, press the "Stop" button. Time will stop flashing and revert to the last treatment time entered. Intensity will revert to zero and the "Ultrasound Active" light will extinguish.

Recently used parameters, with the exception of the output intensity, will remain saved as the default parameters after a treatment ends. To use the same treatment again, enter the desired intensity and press the "Start" button to begin.

Therasound 3 and Therasound 3 EVO Ultrasound Plug & Play Applicators

The Therasound 3 and Therasound 3 EVO will both accept the new Rich-Mar "Plug & Play" series Ultrasound Applicators. The Therasound 3 is limited to two (2) types of applicators, the 5cm² and 10cm², while the Therasound 3 EVO unit will accept and perform with all of the applicators listed below.

5cm²Applicator

The 5cm² Applicator is a dual-frequency (1MHz and 3MHz) ultrasound applicator with an output range from 0 – 10 Watts.

- *Available for both the Therasound 3 and EVO Series*

10cm²Applicator

The 10cm² Applicator operates at 1MHz only with an output range from 0 – 20 Watts or 0 – 2.0W/cm².

- *Available for both the Therasound 3 and EVO Series*

Hammer Applicator (5cm² & 2cm²)

The Hammer Applicator is a dual-frequency (1MHz and 3MHz) ultrasound applicator. The 5cm² transducer provides an output range from 0 – 10 Watts and the 2cm² transducer will provide an output range of 0 – 4 Watts.

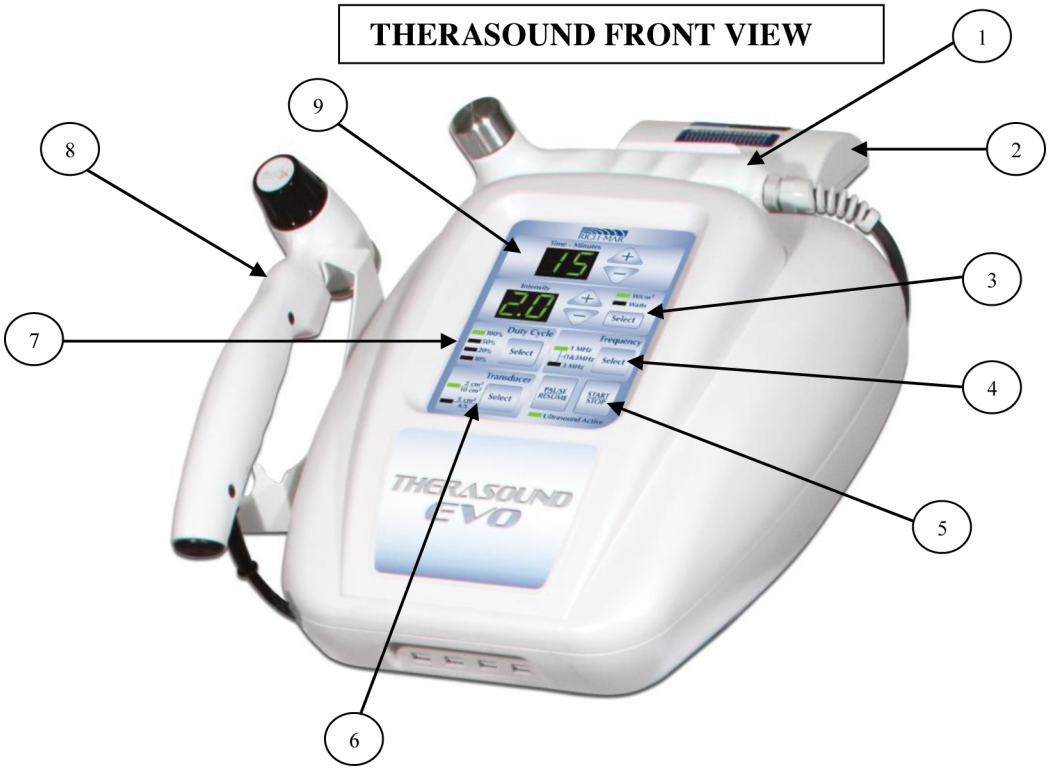
- *Available for EVO Series only*

Autosound Applicator

The Autosound Applicator is a dual-frequency (1MHz and 3MHz) "Hands Free" style applicator. At 1 MHz Output selected, the Autosound Applicator will deliver 0 – 7 Watts and at 3 MHz Output, the Autosound Applicator will deliver 0 – 5 Watts of power.

- *Available for EVO Series only*

THERASOUND FRONT VIEW



USER INTERFACE and THERAPY APPLICATORS

1 – HAMMER STYLE APPLICATOR (Optional)
2 – AUTOSOUND "HANDS FREE" ULTRASOUND APPLICATOR (Optional)
3 – ULTRASOUND INTENSITY SELECT
4 – ULTRASOUND FREQUENCY SELECT
5 – START/ STOP and PAUSE / RESUME KEYS
6 – TRANSDUCER SELECT
7 – DUTY CYCLE SELECT
8 – LASER PROBE (Optional)
9 – TREATMENT TIME SELECT

THERASOUND REAR VIEW

CONNECTION PORTS

1 – ELECTRICAL POWER ENTRY MODULE with ON / OFF SWITCH (115VAC version shown)
2 – LASER POWER PORT ENABLE KEY SWITCH (with EVO Laser Option Only)
3 – TWO (2) LASER / CLD POWER PORTS (with EVO Laser Option Only)
4 – ULTRASOUND APPLICATOR PORT
5 – EXTERNAL ELECTRICAL STIM JACK for COMBO TRATMENTS

Combining Ultrasound with Rich-Mar Stimulation

The Rich-Mar Therasound 3 and Therasound 3 EVO ultrasounds are designed to be connected to any Rich-Mar muscle stimulator, thus enabling the user to provide combination therapy to patients.

To connect the Therasound unit to a stimulator, simply plug an electrode lead from the stimulator into the jack
on the lower right rear side of the Therasound ultrasound unit.
Using the indifferent electrode of the stimulator to complete the circuit with the soundhead of the Therasound, the user will be able to provide electrical stimulation as well as ultrasound through the transducer.
CAUTION: When using a combination treatment, note that both faces of the “Therapy Hammer” transducer will output stimulation.

Disinfecting Recommendations

To disinfect the soundhead between therapy treatments, Rich-Mar recommends using a disinfectant cleaner for ultrasound. OSHA addresses the need for prudent infection control (OSHA Instruction CPL 2- 2.33C) to include decontamination of equipment between patients.

Ultrasound Calibration and Tuning Procedure

Ultrasound Service Information

Rich-Mar Corporation recommends that all Rich-Mar ultrasonic therapy products be returned to the factory or to a servicing Rich-Mar distributor for service or calibration. It is recommended that the device be calibrated annually or when any major component is changed.

Caution

Calibration and peaking adjustments must not be attempted unless the person performing these adjustments has the proper test equipment, which must include an acceptable ultrasonic wattmeter, such as the Ohmic UPM-30 or equivalent. Degassed water must be used to obtain accurate readings (4 parts per million of oxygen).

Warning

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous exposure to ultrasonic energy.

Retention of Calibration Values

The New Plug-In style applicators have been designed with a memory device that will retain the calibration frequency value(s) and voltage value(s) required to properly operate the applicator in it's intended output range. This technology allows the end user to interchange and utilize the Plug-In style applicators with all Therasound 3 EVO units.

NOTE: For the base Therasound 3 model, only the 5cm² and 10cm² applicators are interchangeable.

Calibration and Tuning Procedure

Rich-Mar recommends that the device be calibrated a minimum of once per year.

10cm² Applicator

You need to complete only the 1 MHz portion.

5cm² Applicator

You need to complete both the 5cm @ 1 MHz and the 5cm@3 MHz portions.

Hammer Applicator (5cm² & 2cm²)

You need to complete both the 5cm @ 1MHz, 5cm @ 3MHz, 2cm @ 1MHz, and 2cm @ 3MHz portions.

Tuning Frequency and Setting Voltage

5cm @ 1MHz

1) Install the 5cm soundhead into the wattmeter making sure that only the face of the transducer is submerged. Zero the wattmeter.
2) Hold down the Start/Stop switch and turn on the unit. The software version should appear on the screen.
3) Let off the Start/Stop switch and the frequency will appear on the screen for 5cm@1MHz. Find the frequency peak and add 5kHz.

Note: Normal range of operation is 930 to 960.

4) Press Start/Stop switch and the voltage will appear. Set maximum output to 10 watts.

5cm @ 3MHz

1) Press the Start/Stop switch.
2) Find the frequency peak for 5cm @3MHz and add 7kHz.

Note: Normal range of operation is 3050 to 3150.

3) Press the Start/Stop switch and the voltage will appear. Set maximum output to 10 watts.

2cm @ 1MHz

1) Press the Start/Stop switch.
2) Find the frequency peak for 2cm @ 1MHz and add 5kHz.

Note: Normal range of operation is 950 to 980.

3) Press the Start/Stop switch and the voltage will appear. Set maximum output to 4 watts.

2cm @ 3MHz

1) Press the Start/Stop switch.
2) Find the frequency peak for 2cm @ 3MHz and add 5kHz.

Note: Normal range of operation is 3050 to 3150.

3) Press the Start/Stop switch and the voltage will appear. Set maximum output to 4 watts.

Tuning Frequency and Setting Voltage *cont.*

10cm @ 1MHz

1) Install the 10cm soundhead into the wattmeter making sure that only the face of the transducer is submerged. Zero the wattmeter.
2) Hold down the Start/Stop switch and turn on the unit. The software version should appear on the screen.
3) Let off the Start/Stop switch and the frequency will appear on the screen for 10cm@1MHz. Find the frequency peak and add 5kHz.

Note: Normal range of operation is 900 to 950.

1) Press Start/Stop switch and the voltage will appear. Set maximum output to 20 watts.

Autosound "Hands Free" Applicator

** Due to the complexity of this procedure and the tooling required, it is recommended that the Autosound Applicator be returned to Rich-Mar for calibration purposes.*

Trouble-Shooting

Rich-Mar Corporation takes pride in its Technical Support Hotline: 1-888-549-4945. We have an outstanding staff ready to take your calls and help with diagnosing and troubleshooting problems. Listed below are several options for troubleshooting the Therasound 3 Series.

1.) **The device fails to turn on.**
Check to verify that the power cord is fully plugged into the corcom power entry module below the AC switch on the rear of the device. Also verify that the power cord is fully plugged into the AC wall outlet.
Check the fuse to verify that it has not blown. CAUTION: To ensure personal saftey, unplug the unit before checking the fuse.

2.) **Ultrasonic Active LED fails to Illuminate**
Verify that the soundhead connections are plugged firmly into the main board.

3.) **Display reads "HEAd"**
The "HEAd" warning is a safety feature wherein the soundhead temperature shuts off to avoid overheating. This warning occurs when the soundhead overheats, usually due to an un-coupled or poor coupling situation. Turn the device off for 3-4 minutes to allow it to reset and turn it back on and begin treatment. If the "• • • • • •" warning is still displayed, please call the factory.
When using the Hammer Applicator, check that the soundhead in use is active. Also, be sure to use an adequate amount of coupling gel or lotion specifically designed for ultrasound transmission.

Output Troubleshooting

Rich-Mar suggests that ultrasound output be tested once a week. To do this, turn on the device and start a treatment at 100% output. The outputting head should be facing up towards the user. Pour some water on the soundhead and increase the intensity. If the device is outputting ultrasound, the water should cavitate, or bubble, on the soundhead.

CAUTION: Do not operate the ultrasound in an "unloaded" condition for more than one minute at intensities greater than 1.0 W/cm². It is possible that the transducer may overheat and damage the unit.

Specifications

Therasound 3

Dimensions: 9 1/2"W x 12"D x 6 1/4"H

Weight: 5.6 lbs.

Power Input:
115 VAC at 1.0 Amp / 230 VAC at 0.5 Amp at 50 / 60 Hz.

Therasound 3 EVO

Dimensions: 9 1/2"W x 12"D x 6 1/4"H

Weight: 5.6 lbs.

Power Input:
115 VAC at 1.0 Amp / 230 VAC at 0.5 Amp at 50 / 60 Hz.

Ultrasound Applicator Specifications

5cm Applicator
Soundhead ERA: 5cm²
Frequency: 1MHz & 3MHz
BNR: 5.5:1 maximum
Output: 0-2 w/cm² (0 – 10 Watts +/- 15%)

10cm Applicator
Soundhead ERA: 10cm²
Frequency: 1MHz
BNR: 5.5:1 maximum
Output: 0-2w/cm² (0 – 20 Watts + 0% /- 25%)

Hammer Applicator
Soundhead ERA: 2cm² & 5cm²
Frequency: 1MHz & 3MHz
BNR: 5.5:1 maximum
Outputs:
2cm² = 0 – 2.0w/cm² (0 – 4 Watts +/- 15%)
5cm² = 0 – 2.0w/cm² (0 – 10 Watts +/- 15%)

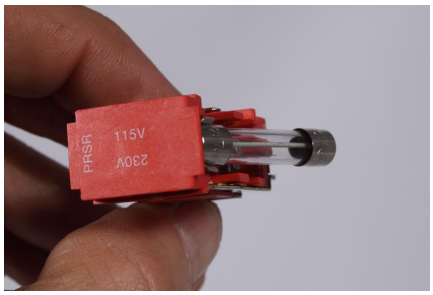
AutoSound Applicator
Soundheads ERA: 3.5cm² – treatment area of 14cm²
Frequencies: 1, 3 MHz, or 1& 3MHz Chain
BNR: 5.5:1 maximum
Ultrasound Output: 0-2.0 W/cm²
Note: AutoSound 3MHz and 1&3MHz Chain are limited to 1.5 W/cm²

Changing the Voltage from 115V to 230V

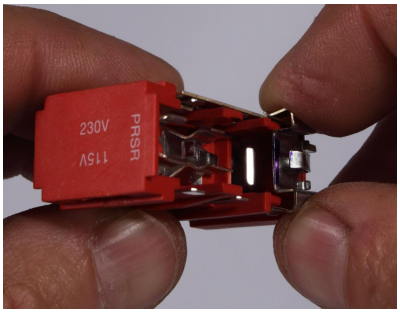
WARNING: RISK OF ELECTRICAL SHOCK.
Unplug unit prior to changing the voltage from 115 to 230.

1. After unplugging the unit, open the outlet cover with a flathead screwdriver by inserting it into the notch as shown above.

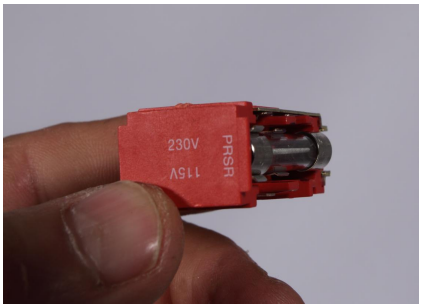
2. Once the outlet cover is open, insert the flathead screwdriver into the notch on the red voltage converter as shown above.



3. Holding the regulator so that 115V is right-side up, remove the 1amp slow blow fuse from the right side.



4. Rotate the regulator until 230V is right-side up. Remove the clip from the right-hand side and insert *two* .5amp slow-blow fuses, one on each side.



5. SAVE THE CLIP AS IT IS NEEDED TO SWITCH BACK TO 115V. After correct fuses are inserted into each side, insert the regulator into the slot with 230V reading right-side up as shown above.

6. Finally, close the outlet cover, ensuring that the desired voltage appears through the window in the outlet cover. Also be sure to use an adapter for the AC plug to suit local wall outlets in use.

115V to 230V Quick Check

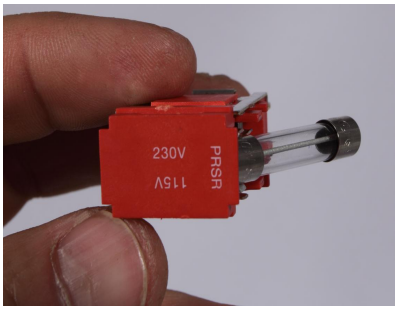
- Take out 1amp slow blow fuse and remove clip on back of 230V side.
- SAVE CLIP
- Insert *two* .5 amp slow blow fuses.
- Insert regulator with 230V appearing through the window in outlet cover.

Changing the Voltage from 230V to 115V

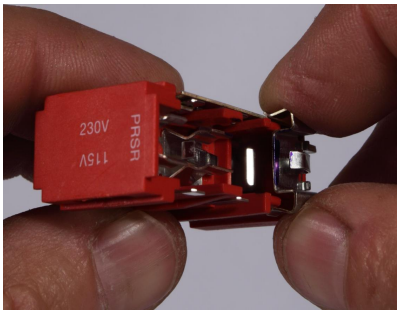
WARNING: RISK OF ELECTRICAL SHOCK.
Unplug unit prior to changing the voltage from 230 to 115.

1. After unplugging the unit, open the outlet cover with a flathead screwdriver by inserting it into the notch as shown above.

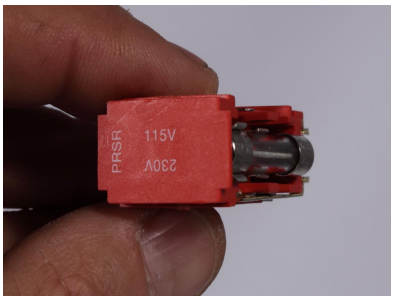
2. Once the outlet cover is open, insert the flathead screwdriver into the notch on the red voltage converter as shown above.



3. Remove the two .5 amp slow blow fuses from the voltage regulator.



4. Hold the regulator so that 230V is right-side up. Insert the clip into the right-hand side of the regulator.



5. Rotate the regulator so that 115V is right-side up and insert one 1 amp slow blow fuse into the right side. Insert the regulator into the slot in the unit with 115V reading right-side up.

6. Close the outlet cover, ensuring that 115V appears through the window in the outlet cover. Also be sure to use an adapter for the AC plug to suit local wall outlets in use.

230V to 115V Quick Check

Take out the two .5 amp slow blow fuses.
INSERT THE CLIP INTO THE RIGHT HAND SIDE OF THE 230V REGULATOR

- , Insert one 1 amp slow blow fuse.
- , Insert regulator with 115V appearing through the window in outlet cover.

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APPENDIX A
ULTRASOUND TECHNICAL INFORMATION

Ultrasound Technical Information

Applicator Type:
The ultrasonic radiation fields produced by Rich-Mar therapeutic ultrasound transducers are of the plane wave type and are essentially cylindrical in shape. This type of applicator is referred to as a collimating applicator.

Applicator Label:
Each Rich-Mar applicator is labeled to provide the user with information on its applicable parameters. The following abbreviations are used on the label.

Gen: The Rich-Mar ultrasonic generator for which the applicator is intended.

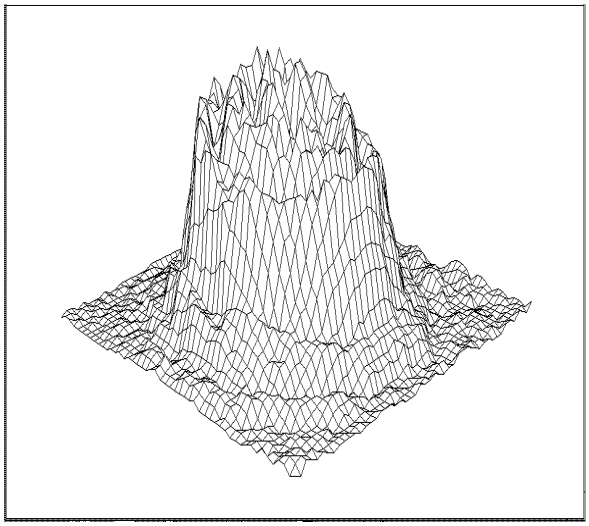
f: The operating frequency in MHz for the applicator.

Area: The effective radiating area of the applicator in square centimeters.

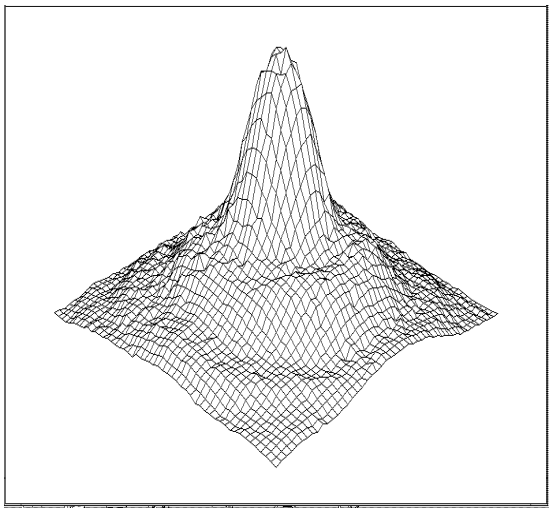
BNR: The Beam Nonuniformity Ratio.

Type: Coll-means collimating applicator.

Near Field/ Far Field:
If measurements are made of the sound intensity along the central axis of the beam produced by the applicator, the intensity distribution shows maxima and minima near the applicator and then a gradual decline beyond the last maximum intensity.
The "interference" or "near field" is the area in the ultrasound beam extending from the applicator surface to the location of the most distant intensity maximum. In this area, maxima and minima of intensity are located close to each other. This is the area in which most therapeutic application occurs. This is shown in the following figure measured 0.5cm from the transducer face.



Near Field Distribution
Beyond this point, the beam has a more uniform intensity and is called the "far field". Below is shown the far field distribution at 16cm from the transducer face.



Far Field Distribution
The preceding descriptions apply for radiation emitted into the equivalent of an infinite medium of distilled, degassed water at 30°C and with line voltage variations in the range of +/-10% of the rated value

Transducer Parameters and Tolerances:
10cm² / 5cm² /Hammer (5cm² & 2cm²) Applicators
The Rich-Mar ultrasound units operate at frequencies of either 1MHz or 3MHz +/- 10%. The effective radiating areas (ERA) of the transducers are ten, five, or two square centimeters, depending upon the size of the transducer being used. The tolerance for the ERA is +/-25% on the 2 and 5 square centimeter transducers. The tolerance for the 10 square centimeter transducers is +0. -25%. The Beam-Nonuniformity-Ratio (BNR) of any Rich-Mar transducer is 5.5:1 or less.

Transducer Parameters and Tolerances: Autosound Applicator

The Rich-Mar ultrasound units operate at frequencies of either 1MHz or 3MHz +/- 10%. The effective radiating areas (ERA) of the transducers are ten, five, three and a half (3.5), or two square centimeters, depending upon the size of the transducer being used. The tolerance for the ERA is +/-25% on the 2, 3.5 and 5 square centimeter transducers. The tolerance for the 10 square centimeter transducers is +0. -25%.

The Beam-Nonuniformity-Ratio (BNR) of any Rich-Mar transducer is 5.5:1 or less.

100% Mode

When operated in the 100% mode, the generator produces a non-interrupted sinusoidal waveform of one or three MHz. The peak power and average power are therefore the same.

The error in indication of radiated power in intensity for the continuous mode does not exceed +/- 14% allowing for a 6% error in the wattmeter, which equals +/- 20%.

Pulsed Mode

When operated in the pulsed mode, the generator produces a square-wave burst of sinusoidal waveform of 1MHz or 3MHz of 2.5 milliseconds in duration. Depending upon the Rich-Mar model of therapeutic ultrasound in use, the duty cycle can be chosen between 5% and 95% duty. This then implies the repetition rate is selectable between 20 and 380 pulses per second. (This is computed by taking the inverse of the duty cycle 1/380 = .95, 1/20 = .05). The tolerance for the pulsed mode is +/- 20%.

See the following chart for second comparison on %Duty cycle to pulses.

% Duty Cycle (Indicated on front panel of device)	Pulses/Second
5	20
10	40
15	60
20	80
25	100
30	120
35	140
40	160
45	180
50	200
55	220
60	240
65	260
70	280
75	300
80	320
85	340
90	360
95	380

The error in indication of radiated power in intensity for the pulsed mode does not exceed +/-14% allowing for an allowable 6% error in the wattmeter, which equals +/-20%.

Timer Accuracy

The Food and Drug Administration requires that the treatment timer accuracy is to within 0.5 minutes for the preset duration of emission for settings less than five minutes, to within 10% of the preset duration of emission for settings from five to ten minutes, and to within one minute of the preset duration of emission for settings greater than ten minutes.

Ratio of Temporal Peak to Temporal Average (Rtpa):

The ratios of temporal peak to temporal average intensities (Rtpa) will vary with the pulse rate of the device. Depending upon the Rich-Mar model of therapeutic ultrasound in use, the duty cycle can be chosen between 5% and 95% duty.

The Rtpa is calculated in the following manner:

Rtpa = (1/Duty):1

Example 5% duty = .05 (min. duty, max. Rtpa)

Rtpa = (1/.05):1

Rtpa = 20:1

Example 95% duty = .95 (max. pulsed duty, min. Rtpa)

Rtpa = (1/.95):1

Rtpa = 1.05:1

See the following chart for %Duty cycle to Rtpa comparison.

% Duty Cycle (Indicated on front panel of device)	Rtpa
5	20:1
10	10:1
15	8.33:1
20	5:1
25	4:1
30	3.33:1
35	2.86:1
40	2.5:1
45	2.22:1
50	2:1
55	1.82:1
60	1.66:1
65	1.54:1
70	1.43:1
75	1.33:1
80	1.25:1
85	1.18:1
90	1.11:1
95	1.05:1

The Rtpa tolerance does not exceed +/- 20%.
The temporal maximum intensity for each duty cycle as well as the 100% modulation is whatever is indicated on the meter.

The temporal average intensity for each duty cycle will be the meter indication multiplied by the percentage duty cycle.

Temporal Average = (Duty) x (Meter Indication)
Example, 5 Watts, 35% Duty
Temporal Average = .35 x 5 Watts = 1.75 Watts

The Spatial Average Intensities for each of these setting will be divided by the transducer's Effective Radiating Area (ERA)

Spatial Average = (Temporal Average)/(ERA)
Example, 5 Watts, 35% Duty, $5cm^2$ Transducer

Spatial Average = (1.75 Watts)/($5cm^2$) = 0.35 Watts/ cm^2

The pulse width (On time) of all Rich-Mar therapeutic ultrasound devices is 2.5 milliseconds (mS). The time between pulses (Off time) in milliseconds is calculated as follows:

Pulse width (On time) = 2.5mS
Off time = [2.5-2.5(%Duty cycle)]/(%Duty cycle)
Where %Duty cycle is represented as a decimal.
Please see the following example for computing the Off time for a 10% Duty cycle:
Off time=[2.5-2.5(0.10)]/(0.10)=22.5 milliseconds.

Additional Technical Notes:

The peak power is the same in the pulsed modes as in the 100% modulated mode.
Unless otherwise stated, all technical parameters are accurate within +/- 20%.
When in the pulse modes the unit is still generating therapeutic heat, although it is an amount reduced by a factor directly related to the duty cycle. The pulse rates are used to allow the practitioner to treat areas of bony prominences without creating periosteal pain.
The line leakage is tested in both the forward and reverse polarities to be less than 50 microamperes exceeding all standards for medical devices in this class.